

# IDRC

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# FEATURE

*A monthly features service on scientific, technical, and educational subjects pertinent to development.*

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## A PUMP THAT WORKS?

by DAVID HENRY

Delegates to the UN sponsored International Water Conference had called for billions of dollars in aid to provide "Water for All" by 1990. The need is great, especially in the rural areas of developing countries, no doubt of that. But too much enthusiasm could be as damaging as too little.

A brief look at the experience with large-scale rural water supply programs in the last decade does not inspire confidence. In one Asian country, for example, about 50,000 wells were drilled in hard rock, drought-prone regions at a cost of about \$40 million. They were intended to bring water to some 40 million people, but today an estimated 80 percent of the wells are no longer producing water. In East and West Africa the same story is repeated, with some countries reporting failure rates of up to 90 percent.

What is wrong? If you ask a villager he will likely show you a rusty piece of machinery sitting on top of a pipe in the ground. The machine was designed over 100 years ago for use in a very different environment, and it has changed very little since. It is called a hand pump. The villager does not think it is a very good piece of machinery -- and he is right.

There are other aspects of the situation: managerial, financial and sociological. But until there is some improvement in the technology these problems will be very difficult to deal with. The present situation is like trying to design a public transit system where the choice of technology is limited to 1920 Ford Model T's.

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What is badly needed, then, is a better hand pump. And a group of scientists at the University of Waterloo in Canada are hoping that they have it. With the support of a grant from the International Development Research Centre, the Waterloo team -- composed of senior members of the engineering faculty with backgrounds in physics, fluidics and mechanical engineering -- has been working on the problem since the beginning of the year.

Their assignment was to "optimize the design of a piston and check valve configuration for use in low-cost rural water pumps." In other words, to produce a pump that is reliable, tough, inexpensive, requires no special maintenance, and can be adapted to local manufacture.

With these factors in mind, the scientists avoided traditional materials such as bronze, brass, cast iron, and mild steel. Instead they have concentrated on the use of plastics and hardwoods. They reasoned that plastic injection moulding could dramatically reduce manufacturing costs, and many developing countries already have the basic injection moulding capacity to produce components.

Bearings are one of the major problems with existing pumps. Yet the bullock carts of India, which carry more freight each day than the Indian railways, run on wooden bearings. The North American petro-chemical industry also imports African hardwoods for use in the manufacture of high stress bearings.

Much of the research on the applicability of local hardwoods for bearings will be carried out by scientists in the developing countries. Now that the Waterloo team has selected the best prototypes from the different designs they produced in the laboratory, the project will move into its second phase: extensive field testing and research.

The most promising prototypes are capable of being adapted to high, medium and low lift, and can be manufactured in four sizes, from 1½ to 3 inches in diameter. This flexibility in design will allow the pumps to meet the wide variations in local conditions that they will encounter in actual use.

Testing in the village is essential. Another research group recently tested a modified pump in the laboratory by operating it for one million strokes. Later someone doing research at the village level discovered that a hand pump under typical village conditions is subjected to between five and nine million strokes per year! That pump has not solved any problems.

Discussions are now underway between the IDRC and five developing countries already engaged in pump development. The aim is to organize a five-year multi-country testing program that will feed the actual field experience back into the design exercise. In this way further modifications can be incorporated if necessary.

It is lengthy process, but it will be worth it. Because the end product will be a hand pump that will provide a positive answer to the three practical questions of the villager: Will it work, will it last, can I afford it?

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